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Indian Standard
SPECIFICATION FOR
MAGNETIC SOUND TAPE RECORDING
AND REPRODUCING EQUIPMENT
(CASSETTE TYPE)

PART I METHODS OF MEASUREMENT

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SPECIFICATION FOR MAGNETIC SOUND TAPE RECORDING AND REPRODUCING EQUIPMENT (CASSETTE TYPE)

PART I METHODS OF MEASUREMENT

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Indian Standard

**SPECIFICATION FOR
MAGNETIC SOUND TAPE RECORDING
AND REPRODUCING EQUIPMENT
(CASSETTE TYPE)**

PART I METHODS OF MEASUREMENT

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 18 July 1978, after the draft finalized by the Recording Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard (Part I) covers the methods of measurement of characteristics of magnetic sound tape recording and reproducing equipment (cassette type) of both domestic and professional types.

0.2.1 This standard applies to complete apparatus only and not to any components parts thereof.

0.3 This standard lays down a single method of measurement for each characteristic so as to achieve the required degree of precision. It is not however, intended to exclude other alternative methods of measurement for which necessary measuring equipments may be available and which are of equal or greater precision than the method prescribed in this standard.

0.4 While preparing this standard, assistance has been derived from IEC Doc : 60A(Central Office)43 'Methods of measuring the characteristics of recording and reproducing equipment for sound on magnetic tape' issued by the International Electrotechnical Commission.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part I) specifies the conditions and procedures for measurement of mechanical and electrical performance characteristics of magnetic sound tape recording and reproducing equipment (cassette type).

2. TERMINOLOGY

2.1 For the purpose of this standard, the terms and definitions specified in IS : 1885 (Part III/Sec 3)-1967* and IS : 8655 (Part I)-1977† shall apply.

3. GENERAL CONDITIONS FOR MEASUREMENTS

3.0 Unless otherwise specified, measurements shall be made under normal measuring conditions as specified in **3.1** to **3.10**.

3.1 Normal Supply Voltage — The rated supply voltage shall be applied to the equipment.

3.1.1 The voltage applied to the equipment shall be held constant within 1·0 percent of the rated value during the measurement of the characteristic.

3.1.2 In case of ac mains operations, the voltage shall be applied at the rated frequency. The harmonic content of ac mains supply voltage shall not exceed 5·0 percent.

3.1.3 In case of battery operation, primary batteries of the type and rated voltage as specified by the manufacturers shall be used.

3.2 Atmospheric Conditions for Test

3.2.1 Unless otherwise specified all measurements shall be carried out under the following atmospheric conditions:

Temperature	15 to 35°C
Relative humidity	45 to 75 percent
Pressure	86 to 106 kPa (1 kPa = 10 mbar)

3.2.2 The equipment shall be protected from draught and direct radiation.

3.3 Reference Frequency — Unless otherwise specified, the reference frequency for measurements shall be 315 Hz.

*Electrotechnical vocabulary: Part III Acoustics, Section 3 Sound recording and reproduction.

†Specification for magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

3.4 Standard Tape Speed — Unless otherwise specified, the standard tape speed shall be 4.76 cm/s.

3.5 Test Frequencies — For measurements to be made at a number of frequencies, the frequencies shall be selected from IS : 2264-1963*.

3.6 Reference Level — The standard reference level shall be defined as short circuited surface induction corresponding to a tape flux of 250 nWb/m.

3.7 Calibration Tape — Calibration tape appropriate to the type and speed of the equipment shall be used.

NOTE — The calibration tape should be identified by the name of the manufacturer and country of manufacture.

3.8 Accuracy of Test Set-Up — The test set-up employed to carry out measurements in accordance with this standard shall have an accuracy of at least one order better than that specified for the quantity under measurement.

3.9 Stereophonic Recording and Reproducing Equipment — Unless otherwise specified, measurements shall be carried out on each channel for stereophonic equipment.

3.10 Reporting — The test report shall clearly indicate the following:

- a) Rated supply voltage type (ac or dc) and frequency in the case of ac,
- b) Atmospheric conditions under which tests are carried out,
- c) Any change of necessary adjustment to the equipment done before measurement, and
- d) Results of tests.

4. OPERATING CONDITIONS

4.1 Before any measurements are made, the unit shall operate at least for the stabilization period specified by the manufacturer or 10 minutes whichever is greater.

4.2 Before any measurements are made all measuring equipment shall have reached temperature stability.

4.3 Apart from the specified load, the measuring equipment shall not introduce additional load which would significantly affect the parameters measured.

*Preferred frequencies for acoustical measurements.

4.4 Before measurements are made, it should be ensured that parts of the equipment near or in contact with the tape are maintained clean and demagnetized.

4.5 Unless permanently connected, all noise reductions and/or automatic gain control circuit shall be rendered inoperative.

5. GENERAL MEASUREMENTS

5.0 The characteristics and its methods of measurements for magnetic sound tape recording and reproducing equipment (cassette type) shall be as specified in Table 1.

TABLE 1 CHARACTERISTICS AND ITS METHOD OF MEASUREMENT

SL No.	CHARACTERISTIC	METHOD OF MEASURE- MENT, REF TO
(1)	(2)	(3)
1	Visual examination	5.1
2	Operational test	5.2
3	Power consumption	5.3
4	Tape speed	5.4
5	Tape transport	5.5
6	Fast forward and rewind duration	5.6
7	Speed fluctuations	5.7
8	Frequency response	5.8
9	Distortion	5.9
10	Input impedance (unbalanced)	6.1,2
11	Minimum source EMF	6.3
12	Maximum source EMF	6.4
13	Output impedance	7.1
14	Line output voltage	7.2
15	Maximum line output voltage	7.3
16	Unbalance of output	7.4
17	Signal-to-noise ratio (electronic noise)	7.6
18	Signal-to-noise ratio (overall)	8.3
19	Cross talk	5.10
20	Channel separation	5.11
21	Output power measurement	5.12
22	Erasing attenuation	8.6
23	Mechanical noise	5.11
24	Magnetic stray field	5.12
25	R-F shielding	Under consideration

*Specification for magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

5.1 Visual Examination — The tape recorder shall be visually examined for checking requirements specified in the relevant specification.

5.2 Operational Test — The preliminary checking shall be done by recording a signal through the microphone and auxiliary input if provided. The signal shall then be reproduced on the loudspeaker provided in the circuit. All mechanical and electrical controls shall be activated and checked for smooth and noise-free operation.

5.3 Power Consumption

5.3.1 For Equipment Powered from the Supply Main — The current (I) in amperes taken from the supply source is measured by means of an ammeter, having a class index not inferior to 2.5 (see IS : 1248-1968*) when the equipment is operating under maximum voltage and load conditions. The mode in which the equipment is operating shall be stated:

$$\text{Maximum power consumption} = (I \times \text{maximum stated voltage}) \text{ VA}$$

5.3.2 For Equipment Powered from Batteries — The current (I) in amperes taken from the batteries is measured by means of an ammeter having a class index not inferior to 2.5 (see IS : 1248-1968*) when the equipment is operating under maximum battery voltage and load conditions. The mode in which the equipment is operating when this measurement is taken shall be stated:

$$\text{Maximum power consumption} = (I \times \text{maximum battery voltage}) \text{ watts}$$

5.4 Tape Speed — The tape speed shall be determined by measuring the time taken for a given length of tape to pass through a fixed point on the equipment in the reproduce mode by means of a suitable timing device. The length is measured with the tape under static tension, that is, tension of the tape when travelling at the uniform speed.

5.4.1 Method 1 — For the purpose of measuring the tape speed, a test tape meant for this purpose and an accurate stop-watch shall be used. The test tape shall be marked at distance of 2.38 m, 4.76 m, 9.53 m and 19.05 m from a common starting point. The tape is wound up in such a way that the starting point will take about 2 seconds before it passes through a fixed observation point or slot in the cassette. For this purpose there shall be a small opening on the side of the equipment.

With the equipment running on the reproduce mode, the time elapsed between successive marks shall be noted. From these measurements the tape speed accuracy shall be determined.

*Specification for direct acting electrical indicating instruments (first revision).

5.4.2 Method 2 — The test tape shall carry a sinusoidal signal which, when reproduced at the relevant standard speed, would result in a reproduced frequency f_o Hz. This tape shall then be played on the equipment in the reproduce mode. The reproduced frequency f_m Hz is measured by means of digital frequency meter.

Then the deviation of mean tape speed from standard speed is given by:

$$V = \frac{f_m - f_o}{f_o} \times 100\%$$

NOTE — It is recommended that f_o is chosen to be 3 150 Hz.

5.4.3 Method 3 — A tone of any frequency such as 1 000 Hz shall be recorded on the test tape over a measured length, the two ends being identified through non-magnetic separator. The time of play shall be measured through an accurate timing device, and the tape speed can be calculated from the measurements of length and time of play.

5.5 Tape Transport — A cassette tape shall be loaded and the equipment operated in the following sequences:

- a) To record for a period of 5 minutes and rewind to the beginning of cassette;
- b) To replay for a period of 5 minutes and rewind to the beginning of the cassette; and
- c) To run the tape in the forward mode to approximately 5 minutes before the end of cassette.

This sequence shall be repeated for a total of 5 times and at no time during the tape start, running or stopping modes, loops or any other unfavourable tape conditions shall develop.

5.6 Fast Forward and Rewind Duration — The fast forward and rewind durations shall be measured for a C60 cassette with stop-watch and the average of these durations for both the directions shall be computed.

5.7 Speed Fluctuations (Wow, Flutter and Drift) — Speed fluctuations shall be measured in accordance with IS : 8152-1976*.

5.8 Frequency Response

5.8.1 All frequency response measurements shall be carried under normal supply voltage conditions specified in 3.1 and after alignment of record/replay head for a maximum output with a calibration tape. This head shall be cleaned and the bias adjusted as per manufacturer's requirements.

*Methods of measurement of speed fluctuations in sound recording and reproducing equipment.

5.8.2 Measurements shall be carried out both across the loudspeaker terminals and line output terminals wherever relevant (as frequency response characteristics across the line of terminals would be very important in case of professional type of recorders). While carrying out the frequency response, the output terminating conditions shall be as follows:

- a) Suitable matched load across the loudspeaker terminals after disconnecting the loudspeakers in case of built-in-loudspeakers,
- b) Suitable matched load across the external loudspeaker terminals when provided. It should also be ensured that the internal loudspeaker is out of the circuit, and
- c) Suitable matched terminations across the line output terminals.

5.8.3 The frequency response of the following sections of the recorder shall be measured as follows.

5.8.3.1 Recorded flux frequency response — The recorded flux frequency response shall be measured in accordance with **6.2** of IS : 8655 (Part I)-1977*.

5.8.3.2 Reproducing frequency response — The reproducing frequency response shall be measured in accordance with **7.5** of IS : 8655 (Part I)-1977*.

5.8.3.3 Overall frequency response — The overall frequency response shall be measured in accordance with **8.1** of IS : 8655 (Part I)-1977*.

5.9 Distortion [see also 8.2 of IS : 8655 (Part I)-1977*] — If adjustable record gain and equalization gain are provided, they shall be adjusted for maximum sensitivity conditions and input signal at reference frequency from a low distortion oscillators is fed to the input of the equipment at a suitable level under appropriate matched conditions so as to achieve the recording level in the blank portion of the calibration tape, equal to the reference level. This recorded portion shall be played back and distortion is measured across the output terminals under the terminated conditions with replay gain adjusted for rated output.

The distortion measurement shall also be carried out with the signal through auxiliary input jack at a Specified level which shall be not less than 100 mV.

5.10 Cross Talk

5.10.1 Mono Two Track — A signal of reference frequency shall be recorded at the maximum recording level on one track of the appropriate calibration tape. The recorded track shall then be played back and the

*Specification for magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement.

output voltage V_1 across the dummy load shall be measured. The second track (blank) shall then be played back at the same setting of the controls and the output V_2 shall be measured. The cross talk expressed in decibels is given by $10 \log_{10} \frac{V_2}{V_1}$.

5.10.2 Stereo Two Track — A signal of reference frequency shall be recorded on a appropriate calibration tape at the maximum recording level on either left or the right channel of one side of the cassette tape. The tape shall then be played back, monitoring the recorded channel. The output voltage V_1 shall be measured on that channel across the dummy load. The tape shall be played on the second channel of the same side (blank) at the same setting of the controls. The output voltage V_2 on this second blank channel shall be measured across the dummy load. The stereo cross talk, expressed in decibels, is given by $20 \log_{10} \frac{V_2}{V_1}$.

5.11 Channel Separation — The channel separation expressed in decibels is given by $20 \log \frac{V_1}{V_2}$, V_1 and V_2 being the same as in cross talk measurement.

5.12 Output Power Measurement — The blank section of the appropriate calibration tape shall be recorded with 315 Hz peak recording level signal, that is, 3 percent distortion. This tape shall be played back and the output shall be measured at the maximum setting of level control.

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ON

RECORDING

IS:

1885 (Part III/Sec 3)-1967 Electrotechnical vocabulary: Part III Acoustics, Section 3 Sound recording and reproduction
2032 (Part XII)-1969 Graphical symbols used in electrotechnology: Part XII Electro-acoustic transducers, recording and reproduction systems
3956-1967 Dimensions of spools for magnetic tapes for sound recording and reproduction
4377-1967 General requirements for magnetic tapes for sound recording and reproduction
4479-1967 Methods of measurements on magnetic tapes for sound recording and reproduction
4480 (Part I)-1967 Magnetic tapes for sound recording and reproduction: Part I Domestic grade
4480 (Part II)-1974 Magnetic tapes for sound recording and reproduction: Part II Professional type
6370-1971 Tape cassettes for domestic use
6391-1971 Magnetic and ceramic phonograph pick-ups
7068-1973 6.25 mm calibration tape
7594 (Part I)-1978 Magnetic sound tape recording and reproducing equipment (cassette type): Part I Methods of measurement
7594 (Part II)-1975 Magnetic sound tape recording and reproducing equipment (portable cassette): Part II Domestic type
8152-1976 Methods of measurement of speed fluctuations in sound recording and reproducing equipment
8234-1976 Spools for magnetic tapes for sound recording and reproduction
8655 (Part I)-1977 Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part I Methods of measurement
8655 (Part III)-1977 Magnetic sound tape recording and reproducing equipment (reel-to-reel): Part III Professional type

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